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The Value-Added Tax Reform Puzzle

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Abstract

This explores the impact of a tax reform in some provinces of China which eliminated the value-added tax on some investment goods. While the goal of the experiment was to encourage upgrading of technology, the results suggest that there was no evident increase overall in fixed investment, and employment fell significantly in the treated provinces and sectors.

The reform reduced the total number of employees for all types of firms. For domestic firms, it reduced employment by almost 8 percent. The results are robust to a variety of approaches, and suggest that the primary impact of the policy has been to induce labor-saving growth. This experiment has since been extended to the rest of China.

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The Value-Added Tax Reform Puzzle

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1. Introduction

Much of the literature in public finance focuses on the role of tax reforms in affecting firm behavior. Policy makers in many countries use tax incentives to encourage firm investment, and China is no different. In China, the value-added tax is the major source of fiscal revenue for the Chinese government, generating much more revenues than any other types of tax. In 2002, the revenue from value-added tax was 814.4 billion RMB, accounting for around 48% of the state total tax revenue in that year. In 2009, the Chinese Ministry of Finance estimated that VAT revenue accounted for approximately 31 percent of China's overall revenue.[1]

Beginning in 2004, the Chinese government implemented a value-added tax reform in three northeast provinces which removes fixed asset investment from the value-added tax base. The reform has since been extended to the whole country, beginning in 2009. The objective of the 2004 reform was to encourage firms to raise investment on fixed assets for production (excluding structures) and to upgrade their machinery and equipment. The goals of the 2009 reform were similar, but in addition the government expressed the need to provide additional assistance to domestic enterprises to help them weather the adverse effects of the crisis, as well as to encourage fixed asset investments to promote an industrial policy now focused on more technologically advanced sectors. [2]

In this paper, we use a firm-level panel dataset ranging from 1998 to 2007 to identify the effect of the 2004 value-added tax reduction in selected provinces on firm behavior,

[1] See www.dorsey.com/china_vat_reform

[2] According to the People's Daily Online, December 9, 2008, quoting Zheng Jianxin, deputy director general of the taxation department of China's Ministry of Finance, "The VAT reform would encourage investment and technological upgrading at Chinese companies, boost domestic demand, improve companies' competitive strength and play a positive role in helping companies tackle the financial crisis". The article also states that "The reform was aimed at a shift from the existing production-based to a consumption-based VAT regime, which would enable companies to get tax deductions on spending on fixed assets, Zheng said, adding that this would reduce the tax burden on companies by more than 123 billion Yuan."

including employment, investment, profit, productivity, and exports. Although tax reduction is an important fiscal policy, identifying the effect of it is challenging because of the endogeneity of taxes. The government's choice of tax reduction in areas or sectors is non-random, and usually depends on sector or firm attributes such as size, productivity, capital intensity, ownership, etc. This creates a potential selection bias in policy treatment and makes it hard to identify the causal effect of tax policies.

Consider the value-added tax reform of China in 2004: the three northeast provinces were chosen as the first pilot group because while many coastal cities had undergone rapid changes and upgrades in both capital assets and technology after the opening-up of the Chinese economy to the world, the traditional industrial base in northeast regions are left behind in the race of technological advancement and prosperity. Encouraging firms in these provinces to invest more on fixed productive assets to upgrade their technology, and to revitalize these old industrial bases was the main reason to implement the value-added tax reform in these provinces first.[3] As a result, we cannot identify the causal effect of the value-added tax reform without first addressing potential endogeneity issues.

We use a nonparametric technique, propensity score matching combined with difference-in-difference estimation, to identify the causal effect of value-added tax reduction. This method has two advantages. First, it emphasizes the comparability of the treated and control firms by excluding firms that are not comparable. Second, it relaxes the parametric assumptions associated with regression-based techniques such as the linear regression framework. We assess the credibility of the matching procedure using absolute standardized bias measure and formal paired t-tests. Moreover, we combine the matching

[3] According to the Xinhua News Agency on December 22, 2005, "The experiment, which moves the tax from production to tax on consumer spending has encouraged northeast China to increase investment in machinery and equipment and phase out outdated equipment".

technique with difference-in-difference estimation to deal with concerns about possible unobservable firm characteristics that share the same time dynamics for both treatment and control firms.

Our estimation results suggest that while the reform was effective in reducing the value-added tax paid by firms, its impact on firm behavior in other ways is puzzling. The policy significantly reduced firms' total number of employees for both domestic and foreign firms. Second, the impact of the tax reduction on firm productive investment was limited: while there is some evidence that SOEs increased their investment, the impact was not significant for most other types of enterprises. The impact of the policy on firm profits was similar: while most of the benefits accrued to SOEs, other firms were generally unaffected. Finally, the tax reform did not have any significant effect on firm productivity for all types of firms, and it decreased export intensity for most types of firms.

Our results differ in significant ways from Nie, Fang, and Lie (2010), who also explore the impact of the value-added tax reform in China. They find smaller, but still negative effects on employment and positive, significant effects on fixed asset investment. Our results differ in large part from Nie, Fang, and Lie (2010) for two reasons. First, they only had one year of data following the 2004 reform, while we have three years, which allows us to identify the longer term effects. In addition, they do not address the potential endogeneity of the reform targets, while we explicitly address this through nonparametric propensity score matching techniques. Using their same approach, we show that the beneficial effects of the reform on investment was limited to SOEs and was

very short-term. Even for SOEs, the positive impact on fixed investment disappears if we include 2006 and 2007.

Our evidence suggests that the primary effects of the tax reform were to reduce value-added tax payments and cut employment, as firms shifted to more capital-intensive or labor-saving technologies. While there were some small increases in productive investments, they appear to have been concentrated in SOEs and were not large. Instead, SOEs appear to have benefited primarily through increased profits. One puzzle is why, in light of these limited gains, the policy was extended to the rest of China. One possible explanation is that the VAT reform was part of a package of measures for fiscal stimulus during the 2008-2009 financial crisis.

The remainder of the paper is organized as follows. In Section 2, we discuss the value-added tax system and the tax reform in China. Section 3 discusses the identification strategy. Section 4 presents estimation results. Section 5 shows robustness checks and results. Section 6 concludes.

2. Background

Mainland China introduced the value-added tax as part of a major general tax reform initiative in 1994. There are three types of value-added taxes with different tax bases: the first type is a GDP-type value-added tax with GDP as the tax base; under that system, no deductions are allowed for capital investment and depreciation when calculating the tax base. The tax is equivalent to a sales tax applicable to both consumer and capital goods. The second one is an income-type value-added tax with income or saving plus

consumption as the tax base. The third type is a consumption-based value-added tax, for which the tax base is consumption with investment excluded.

Prior to 2004, China adopted the first type of value-added tax. The value-added tax rate is 17% for most products and 13% for some products such as agricultural products. Export enterprises receive value-added tax refunds as an export incentive, with refund rates ranging from 9% to 17%. The GDP-type value-added tax is effective in ensuring fiscal revenue for the country but does not encourage capital investment. When firms purchase equipment, they pay value-added taxes on the input which is included in the purchase price of the equipment. But this part is not deductible against output value-added taxes associated with the finished goods. When they sell the product, consumers indirectly pay value-added taxes again for the same equipment in the form of higher sales prices. As a result, there is a double taxation on equipment purchases.

In order to promote an equitable market environment and to stimulate investment, in July 2004, the Chinese government selected three northeastern provinces as a pilot area to implement the consumption-type of value-added tax. In these provinces, value-added tax payers in six selected industries, including agricultural product processing, equipment manufacturing, petrochemical, metallurgy, ship building and automobile manufacturing, were allowed to deduct expenditure on fixed assets from the value-added tax base. This reform was expected to eliminate double taxation and alleviate firms' tax burden, which as a result could lower prices for consumers and encourage more investment on fixed assets. At the end of that year, the government further included military products and high-tech products as pilot sectors and extended the scope of the tax deduction from incremental quantity to the full amount of fixed assets. In 2007, the reform was extended

to six provinces in the central area, including 26 cities. In 2008, eastern Inner Mongolia was further included, and finally in January 2009, the consumption-based value-added tax policy was implemented in all sectors and provinces of China.

3. Data, Variable Definitions and Summary Statistics

3.1 Dataset

The data for this analysis comes from a large dataset developed and maintained by the National Bureau of Statistics of China (NBS). The NBS dataset contains annual firm-level unbalanced survey data of all "above scale" industrial firms with annual sales of more than 5 million RMB. On average, around 220,000 firms per year from 1998 to 2007 are included in the dataset, spanning 37 two-digit manufacturing industries and 31 provinces or province-equivalent municipal cities. They account for most of China's industrial value added and have 22% of China's urban employment in 2005.

The combined dataset contains detailed information about each firm's identity, address, industry classification, incorporation year, ownership types, new products and total value of output, total fixed assets, fixed assets for production, sales revenue, profit, total workforce, export sales, total industrial sales, employee educations, income and value added tax payable, etc. These are the key variables based on which we estimate firm level total factor productivity and value added tax reform impacts.

The original dataset includes 2,226,104 firm-year observations. Since the paper focuses on manufacturing firms, we eliminate non-manufacturing observations. To further clean the sample, we delete observations whose information on variables such as firm identifiers, county code, sector id, year established are missing, or observations with

negative or zero values for key variables such as output, total workforce, capital, and total wages. In addition, observations are dropped if total assets are less than liquid assets or total fixed assets. After implementing these data cleaning procedures, we obtain a sample of 1,894,660 observations for analysis.

3.2 Variable Definitions and Summary Statistics

In Table 1, we provide summary statistics for key variables of the analysis. The main outcome variables we consider include employment, investment, profit, total factor productivity (TFP), and export intensity. Employment is defined as total number of employees. Investment is measured in two ways: the first measure is fixed assets for production, and the second measure is the growth of fixed assets plus depreciation. Profit is rescaled by industrial sales. We did not delete firms with negative profits because otherwise it is not a random sample. Value of total fixed assets and fixed assets for production is deflated by the fixed assets investment index. TFP is the firm level total factor productivity estimated using OLS with firm fixed effects. Export intensity is calculated by the ratio of export procurement to total industrial sales. Our key controls include firm size, age, HKTM share, foreign share and state shares. Firm size is measured by total values of output, which are deflated by the sector-specific ex-factory price index of industrial products. HKTM share, foreign share, and state share are defined as the share of the firm's total equity owned by Hong Kong-Taiwan-Macau investors, investors from other countries, and the state, respectively. These three firm level controls are continuous variables ranging from 0 to 1.

In Figure 1, we illustrate the evolution of the value added tax in treated and control groups (rescaled by industrial sales) from 1998 to 2007. First, over the sample period, the

value added tax of firms in treated sectors in control provinces does not change much from year to year. Second, we compare the evolution of value added tax between firms in treated sectors in treated provinces and firms in treated sectors in control provinces. We can see that before 2004, the value added tax of treated firms is always higher than that of control firms in treated sectors. However, one year after the value added tax reform was implemented in 2004, there is a significant decrease in the value added tax paid by treated firms, it reaches a similar value to control firms in treated sectors in 2005, and falls in 2006 and 2007.

In Table 2, we compare the evolution of the value added tax from 1998 to 2007 between firms with different ownership. For foreign invested firms, the value added tax did not decrease after the reform was implemented; it even increased a little bit after 2004, and the trend is very similar between treatment and control firms. This is because before the reform, there were already some tax exemption policies for foreign invested firms. For domestic firms, there is no significant change in value added tax before and after 2004 for control firms; for treated firms, the value added tax was stable before 2004 but fell annually beginning in 2004. This trend holds for both state owned and non-state owned domestic firms, and is more significant for non state owned domestic firms.

4. Identification Strategy

In order to identify the causal effect of value added tax reform on a firm's behavior, the best way is to compare the behavior of a firm that is exposed to the reform with that of the same firm if it had not experienced the reform. However, this sort of counterfactual is rarely observable. In our case, although the policy was only implemented on certain

sectors in certain provinces, the assignment was not random. It is possible that these sectors or provinces were chosen because they fell behind other sectors or provinces in investment, or because they are more capital intensive and reducing the value added tax is more important for these types of enterprises. As a result, the key difficulty with identifying the causal effect of value added tax reform is endogenous selection. To solve the endogeneity problem, we use a two-stage identification approach. First, we use nonlinear propensity score matching techniques to construct a control group of firms that match most closely firms that have been treated based on observable characteristics; Second, we estimate the program impact using the difference-in-difference approach to remove all unobservable effects that have the same time dynamics in the treatment and matched control group.

4.1 Propensity Score Matching

While a number of methods are available for estimating treatment effects using nonlinear matching techniques, we adopt a procedure using Gaussian kernel matching introduced by Becker and Ichino (2002). To identify the most appropriate control group, we need to specify a list of covariates as key determinants of policy assignment. Here we use sector, foreign share, state share, export share, firm size, age, capital, and productivity as matching covariates, or in other words, firms in the control group are matched to the treatment group on the basis of the pre-treatment (1998-2003) mean of these observables.

There are two steps to test whether the propensity score matching method works well. First, we need to estimate whether the covariates we chose are actually important determinants of policy treatment. For this, we estimate a probit model for the likelihood of the value added tax reform treatment:

$$Treatment_{ij} = a_0 + a_1 ForeignShare_{ij} + a_2 HKTMShare_{ij} + a_3 StateShare_{ij} + a_4 ExportShare_{ij} + a_5 logOutput_{ij} + a_6 Capital_{ij} + a_7 Age_{ij} + a_8 logTFP_{ij} + a_9 Sector_{ij} + \epsilon_{ij} \quad (1)$$

Where $\boldsymbol{Treatment_{ij}}$ is a dummy variable which equals 1 if firm *i* in sector *j* was exposed to the tax reform in 2004 and 0 otherwise, and $\boldsymbol{Sector_{ij}}$ includes a set of two-digit sector dummies. Second, we calculate the standardized differences for covariates in the probit regression to assess the performance of our propensity score matching. Specifically, for each covariate, we take the average difference between treated and matched control firms, and then normalize it by the pooled standard deviation of the covariate in the treatment and control groups, which is referred as the absolute standardized bias (ASB). While there is no clear criterion for the value of ASB, Rosenbaum and Rubin (1985) suggests that a value of 20 is large. Moreover, we perform a formal pairwise t-test comparison between treated and matched control firms to see whether there are any significant differences. Throughout we impose the common support condition and confine our attention to the matched firms falling within the support of the propensity score distribution of the treated group.

4.2 Difference-in-Difference Estimation

Using difference-in-differences is likely to improve the quality of non-experimental evaluation studies because it removes the time invariant unobserved heterogeneity across firms, such as sector specific effects, managerial behavior, etc. Here we define the first difference of outcome variables, including total number of employees, investment, profit, TFP, and export in two ways. The first method is to take the difference between post-treatment (2005-2007) and pre-treatment (1998-2003) means of outcome variables, which means we only keep a balanced sample with firms exist in the sample both before and

after the policy treatment. The second method is to take the growth of outcome variables from 2003, which is one year before the policy enacted, to 2007, which is the end of the sample period. In this case, we only keep firms that exist in the data for both 2003 and 2007.

We now explicitly show the formula we use to combine propensity score matching with difference-in-difference estimation. In the standard difference-in-difference estimation, we treat each of the firms linearly and with the same weight, while the difference-in-difference estimator paired with propensity score matching allows us to include only treated firms within the common support and picks control firms according to the metric function specific to the matching method. The estimator is as follows:

$$\hat{\hat{\beta}}_{DDM} = \frac{1}{n_1} \sum_{i \in I_1 \cap S_P} \left[(Y_{it} - Y_{it-1}) - \sum_{j \in I_0 \cap S_P} W(P_{it}, P_{jt})(Y_{jt} - Y_{jt-1}) \right]$$

Where $I_1 \cap S_P$ is the set of treated firms that falls within the common support S_p, I_0 is the set of control firms, and n_1 if the number of treated firms in the common support set. Y is outcome variables and P measures the probability of receiving treatment based on the vector of firm characteristics X_{it-1}:

$$P_{it} = E(D_{it} = 1 | X_{it-1})$$

$W(.)$ is a Gaussian kernel weighting function that depends on the propensity score distance between the treated and control firms:

$$W(P_{it}, P_{jt}) = \frac{G(\frac{P_{jt} - P_{it}}{a_n})}{\sum_{k \in I_0 \cap S_p} G(\frac{P_{kt} - P_{it}}{a_n})}$$

Where $G(.)$ is the Gaussian normal function where $G(x) = e^{-\frac{x^2}{2}}$ and a_n is a bandwidth parameter. $\hat{\hat{\beta}}_{DDM}$ is the estimator of the causal effect of the value added tax reform, and we obtain standard error using bootstrap procedure.

5. Estimation Results

5.1 Propensity Score Matching Estimation Results

In this section, we analyze the estimation result of the probit model for the policy treatment and the matching balance test. First, in Table 3, we show the results of the probit regression. The dependent variable is a dummy variable which takes a value of 1 if a firm was included in the value added tax reform treatment group and 0 otherwise. The objective is to check whether the covariates we chose are important determinants of policy treatment. All covariates are measured by the mean before the policy treatment. Columns (1) to (3) reports estimation results when we define first difference of outcome variables as the growth from 2003 to 2007, while columns (4) to (6) displays results if we define it as the difference between pre and post treatment means.

We find that for both domestic and foreign firms, most covariates are significant determinants of policy treatment. Specifically, firms are more likely to receive policy treatment if they have lower foreign shares or HKTM shares, or higher state shares. Export-oriented firms are less likely to be treated, and firms with less output or more capital are more likely to be included. Younger firms or firms with higher productivity have a higher probability of being selected. The results confirm that the focus of the reform was on regions with less foreign investment, a larger state enterprise presence,

less competition through export activity, and smaller firms. These results are consistent with the anecdotal and press reports that the goal of the initial 2004 reform was to encourage upgrading in the more backward northeastern provinces.

Table 4 reports the balancing test results based on the Gaussian kernel matching. The ASB measures reported in column (3) are all below 5% in absolute value in the matched sample. Adopting the matching method reduced bias substantially as shown in column (4). Moreover, there's no significant difference in covariates we chosen between treated and matched samples. The only exception is that the ASB measure of logTFP increases greatly after matching. However, after matching the measure is still well below 20, and the t-test of difference between treatment and matched groups is not significant. Overall, the quality of the matching procedure is good and provides a solid foundation for the difference-in-difference estimation in the next stage.

5.2 Difference-in-Difference Estimation Results

Having demonstrated the quality of the matching procedure, we then present the difference-in-difference matching estimation results. As discussed earlier, we use two specifications to define first difference of outcome variables. Results are listed in Tables 5.1 and 5.2 for these two specifications, respectively. Since the estimation results do not vary much between different specifications, we will focus on Table 5.1. We present results for the overall sample, domestic (state-owned and non-state-owned), and foreign firms separately.

We begin by looking at the effect of the tax reform on value-added taxes paid by firms. The estimates show that overall, the reported value-added tax paid (rescaled by industrial sales) by treated firms becomes 0.008 less than that paid by control firms. This

effect is statistically and economically significant given that the mean of value-added tax before the policy was implemented was around 0.09. This suggests that the value-added tax reform effectively decreased taxes paid by treated firms. The magnitude of effect varies by firm ownership. The effect is largest for domestic state-owned firms: the reform reduced the value-added tax ratio by 7.6% for treated firms. For domestic non-state-owned firms, the reform also reduced tax paid by around 0.7%. These numbers indicate that the tax reform reduced the tax burden for SOEs ten times more than for non-SOEs. Taxes paid by treated foreign firms also decreased by 0.5% but the effect is not significant. This is consistent with the fact that the reform itself focused on domestic and particularly state owned enterprises, while foreign firms already faced favorable value-added tax policies before the reform. In summary, value-added tax reform significantly reduced the tax paid by domestic firms, but did not have a large impact on foreign firms.

We then turn to the impact of the tax reduction on firm behavior. We consider employment first. Results suggest that the reform reduced the total number of employees for all types of firms. For domestic firms, it reduced employment by almost 8%, but the effect is only significant for domestic non-state-owned firms. For state-owned firms, the magnitude is around 6% but it is not statistically significant. This might because we do not have sufficient power for state-owned firms. The tax reform has a smaller effect on employment of foreign firms: they reduced employment by around 6%.

Second, we estimate the impact of tax reform on firm investment. In this paper, we use two measures for firm investment. The first one is fixed assets for production, which includes equipment, machinery, etc.; the second measurement is the growth of fixed assets plus depreciation. Based on the first measure of investment, we see that the tax

reform did not influence the investment behavior of domestic non-state-owned firms. It raised state-owned firm investment by 12.26%, but the effect is only significant at the 10 percent level. For foreign invested firms, after the reform, their investment was reduced by 8%. However, if we define investment as growth of fixed assets plus depreciation, the impact of value-added tax reform on firm investment is insignificant for all types of firms. Taken together, the results suggest a shift in the composition of investment, which is most evident for SOEs but is not significant at conventional levels.

Third, the value-added tax reform affected the profit of domestic state-owned firms and foreign firms. It raised the ratio of profit to industrial sales of domestic state-owned firms by 0.48 (the sample mean of profit ratio is around 6.66), but did not affect the profit of domestic non-state-owned firms. However, foreign firms' profit was reduced by a small amount of around 0.02 after the policy change. Overall, domestically owned firm profits increased significantly, but the gains were concentrated in SOEs.

Fourth, we also check whether the tax reform affected firm productivity. However, the result suggests that the reform did not have any effect on firm productivity for any types of firms. The effect is small and insignificant for firms with any types of ownership.

Finally, we consider export activity. According to the estimation results, firms' export intensity, which is measured by the share of export procurement in industrial sales, significantly fell after the tax reform policy. The effect holds for all firms except for state-owned firms. The export intensity of domestic non-state-owned firms decreased by 0.008 (sample mean of export intensity equals 0.17) after 2004. The effect on foreign firms is very large. The reform reduced export intensity of foreign firms by 0.06.

In summary, the value-added tax reform reduced firms' tax burden significantly. It had a significantly negative effect on employment, and the effect is very robust. While the main stated objective of implementing value-added tax reform was to encourage firms to invest more on machinery and equipment, we do not find a large and significant effect of the reform on firm investment for most firms. It only raised investment for domestic state-owned firms. Similarly, the reform only raised profits for state-owned firms, while profits of foreign firms fell. We did not find any significantly effect of tax reform on firm productivity. Finally, the policy reduced export intensity for most firms.

6. Alternative Specifications

6.1 Instrumental Variable Estimation

The results indicate that the reform did not generate the expected large positive effect on firm investment. Moreover, even for foreign firms where the value-added tax did not fall significantly after the reform, we see a similar effect of the policy treatment on employment reduction, investment and even export reduction. This suggests maybe there are some other targeted changes that occurred together with the value-added tax reform in these treated sectors and provinces, which could influence firm behavior in similar ways. In order to check whether the above results are actually driven by value-added tax reduction, we use a more direct method to study the tax impact in this section.

While in the last section, we defined policy treatment based on the sector and province in which a firm is located, it is not necessarily true that for all these firms, the value-added tax actually fell after 2004. A more direct way is to see whether a firm actually paid a smaller amount of value-added tax, and estimate the effect of tax

reduction on firm behavior to see whether we can get similar results as above. The OLS estimating equation is as follows:

$$Y\_DIF_{ij} = b_0 + b_1 TaxReduction_{ij} + b_2 X_{ij} + b_3 \eta_j + \epsilon_{ij} \quad (2)$$

Where Y_DIF_{ij} is the difference in outcome variables before and after year 2004. We consider the same set of outcome variables as before, including employment, investment, profit, TFP, and export. As before, we use two specifications to define the difference: one is to take the growth from 2003 to 2007, and the other is to take the difference between post-treatment mean and pre-treatment mean. TaxReduction_{ij} is a dummy variable which equals one if the value-added tax fell after 2004 and zero otherwise. X_{ij} includes firm level controls including foreign share, state share, export share, firm size, age, capital, and productivity. η_j is a set of sector dummies.

In order to solve the endogeneity problem, we use the policy change, which is a binary variable that takes the value of one if a firm falls in treated sectors in treated provinces and zero otherwise, as the instrument for the variable $TaxReduction_{ij}$. The advantage of this method is that we can directly go from policy change to value-added tax changes to specific outcomes, while the disadvantage is that there is still potential endogeneity if the program was not completely exogenous.

The OLS estimation results are listed in table 6.1 and 6.2. In Table 6.1, we show the result if we specify the first difference of outcome variables as the growth from 2003 to 2007, while Table 6.2 presents results when we define it as the difference between before and after 2004. We will focus on Table 6.1 here since estimation results do not vary significantly across the two different specifications. The results in the first column indicate that for firms which experienced a fall in value-added taxes, employment fell.

The average fall in employment for these firms ranged from 2 to nearly 6 percentage points. The biggest reduction in employment in conjunction with the falling value-added taxes where experienced by SOEs. However, there is no evidence of increasing physical capital or overall investment increase associated with the value-added tax reduction. Consistent with the reduction in employment, total factor productivity increased for those firms, but profits were not significantly affected.

The IV estimation results, where value-added taxes paid by the enterprise are instrumented with the 2004 policy change, are reported in Tables 7.1 and 7.2. In Table 7.1 we define differences in outcome variables as the growth from 2003 to 2007. The first column reports the first stage results of regressing the dummy variable for VAT tax reduction on the treatment. As expected, the coefficient is positive and statistically significant for most firms, indicating that the share of value-added taxes in sales fell for firms in the treatment group.

The results for employment are similar to our difference-in-difference matching estimation as well as the OLS results in Tables 6.1 and 6.2. Overall, the tax reduction had a negative effect on the number of employees. Second, consider the impact of tax reduction on firm investment, when using IV estimation, we cannot find a significant effect. Similarly, the IV results suggest after the value-added tax was reduced, firms' profit (standardized by industrial sales) did not change significantly.

6.2 Other Specifications and Robustness Tests

In July 2007, the value-added tax reform was extended to 26 middle cities. We did not exclude 2007 in our results. However, in unreported extensions we tested the

robustness of our results in two ways. First we restricted the sample to 1998 through 2006 and redid our estimates. Second, we used 1998-2007 but excluded the 26 middle cities. The results are robust to both these extensions.

We also reproduced the specifications employed by Nie, Fang, and Li (2010) in Appendix Tables 1 through 3. In order to see why we get different results, we use their variable definitions, with investment defined as annual growth in fixed assets, and the same control variables. The dependent variable is the mean post 2004 – the mean before 2004 and the independent variables are the means before 2004. According to Appendix Table 1 columns (1) - (3), using the same years 1999-2003 and 2005, we can get the same sign and similar magnitudes of effects as Nie, Fang, and Li (2010). However, if we extend the sample to 1998-2007 and do the same estimation, the results reported in columns (4) - (6) show that the effect on fixed investment is much smaller and becomes insignificant. There are other problems with their approach in addition to lack of robustness over the longer time horizon. For example, they do not address the potential endogeneity of treatment, and their definition of investment is problematic too (the value of fixed assets is measured in nominal terms and depreciation is not taken into account).

Appendix Tables A.2 and A.3 separate the results into SOEs and non-SOEs. The results in Appendix Table A.2 show that the results in Nie et al are driven by the changes in fixed investment across SOEs. Comparing the first three and last three columns, which include 2006 and 2007, we see that the significant effects on investment were only present in 2005, and disappear if we add 2006 and 2007. Appendix Table A.3 reports the results for non-SOEs, for which the impact on fixed investment was negative. Overall, these additional tables confirm that the positive impact on investment was short-lived and

limited to SOEs, while the negative and significant impact on employment is evident across all ownership types and increases in magnitude over time.

7. Conclusions

This paper analyzes the impact of the value-added tax reform in China on firm employment, investment, profit, TFP, and export intensity. We use a difference-in-difference propensity score matching approach to identify the causal effect. We find that the reform significantly reduced firms' tax burden. The tax reduction also reduced firm employment for both domestic and foreign firms, while its effect on firm investment was limited, and only positively significant for state-owned enterprises (SOEs). The profits of domestic firms improved after the tax burden was partially removed, while the profits and investments of foreign firms fell. The impact on firm productivity is only significant for domestic firms and the effect is negative. Finally, for most firms, their exports fell in conjunction with the value-added tax reform.

Our results suggest that the reform was targeted at provinces with a large number of state owned enterprises, less foreign ownership, more capital intensity and less outward orientation. Using our matching estimation as well as other approaches such as instrumental variables using the targeted sectors and provinces as instruments for the change in value-added taxes, we find that the 2004 tax reform led firms to use fewer workers, increased profits for SOEs, and led to some increase in productive investment among SOEs but no significant change for other enterprises. The insignificant effects that we find on productive investment for non-SOEs, combined with the fall in

employment across the board, are puzzling. We intend to do further research to identify whether more detailed data on investment categories could show a shift among non-SOEs towards labor-saving technology as a result of the reform.

Our most robust finding is the significant reduction in employment among treated firms. Treated firms reduced employment between 6 and 8 percentage points. One policy problem that should be considered for future research is whether encouraging such labor-saving changes are optimal. Policy changes in both developed and developing countries appear to be encouraging manufacturing growth which leads to small increases in employment. For the US, for example, Ebenstein, Harrison, McMillan and Phillips (2011) show that falling prices of investment goods led to a reduction in domestic manufacturing employment.

Since the benefits from the reform in terms of increasing aggregate investment and even productive investment seem quite limited, one question is why the reform was extended to the rest of China. One likely explanation is that extending the reform to the rest of China was part of a comprehensive stimulus package in response to the 2008-2009 financial crisis.

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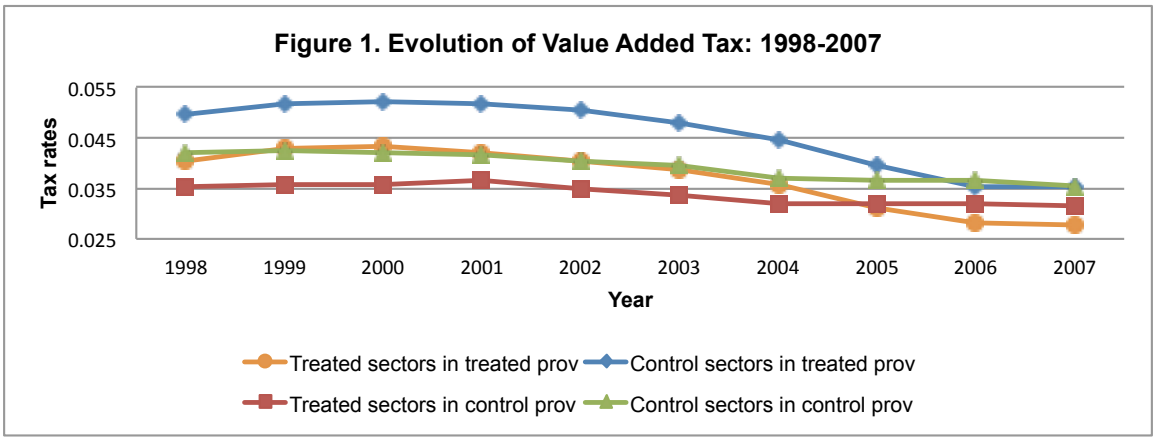
Figures and Tables



Note: The variable value added tax is defined as the ratio of reported value added tax to industrial sales.

Table 1. Summary Statistics of Key Variables, 1998 - 2007

	# of Obs.	Mean	St. Dev.	Minimum	Maximum
log(Labor)	1894660	4.75	1.15	0.00	12.15
log(Fixedasset)	1894660	8.28	1.71	-0.16	18.03
log(Fixed assets for production)	1825161	8.44	1.70	-1.21	18.68
log(Investment)	823890	6.72	2.12	-6.55	17.26
log(Output)	1894660	9.96	1.36	0.62	19.49
Profit/Industrial sales	1893780	0.00	6.66	-7710.80	2515.00
log(TFP)	1825161	2.00	0.37	-0.19	14.06
Export Intensity	1893780	0.17	0.34	0	1
Foreign Share	1894645	0.07	0.24	0	1
HKTM Share	1590548	0.08	0.25	0	1
State Share	1894627	0.10	0.29	0	1
Age	1892729	14.65	12.57	1	819

and value of output are deflated values. Investment is calculated as the growth of fixed assets for production plus depreciation. TFP is estimated using OLS fixed effect method. Export intensity is defined as the export procurement divided by industrial sales. Foreign share contributed by HK-Taiwan-Macau equals the share of firms' total equity owned by investors from HK-Taiwan-Macau. foreign share contributed by other countries is defined as the share of firms' total equity owned by investors outside HK-Taiwan-Macau, principally from OECD countries. State share equals the proportion of firms' state assets to its total equity.

Table 2. Evolution of Value Added Tax, 1998 - 2007

	All Sample		Foreign invested		Domestic		Domestic Non-SOE		Domestic SOE	
	Treated	Control	Treated	Control	Treated	Control	Treated	Control	Treated	Control
1998	0.0888	0.0915	0.0734	0.0782	0.0919	0.0947	0.0955	0.0960	0.0869	0.0922
1999	0.0888	0.0976	0.0773	0.0798	0.0912	0.1021	0.0940	0.0965	0.0867	0.1150
2000	0.0925	0.1289	0.0776	0.2268	0.0964	0.1025	0.1012	0.1066	0.0855	0.0895
2001	0.0921	0.0985	0.0831	0.0902	0.0943	0.1008	0.0965	0.1040	0.0883	0.0866
2002	0.0890	0.0972	0.0799	0.0923	0.0914	0.0986	0.0918	0.1002	0.0898	0.0891
2003	0.0920	0.1010	0.0795	0.0902	0.0953	0.1040	0.0954	0.1056	0.0947	0.0904
2004	0.1032	0.1118	0.0896	0.1002	0.1067	0.1150	0.1055	0.1161	0.1157	0.1003
2005	0.0952	0.1033	0.0955	0.0930	0.0952	0.1063	0.0936	0.1070	0.1181	0.0920
2006	0.0872	0.1083	0.0875	0.0951	0.0872	0.1119	0.0867	0.1126	0.0976	0.0933
2007	0.0849	0.1040	0.0854	0.0980	0.0849	0.1047	0.0844	0.1043	0.0999	0.1222
Observations	88,200	1,805,580	15,466	353,294	72,733	1,452,275	62,479	1,284,952	10,254	167,323
Total	0.0911	0.1048	0.0848	0.1022	0.0924	0.1054	0.0923	0.1065	0.0936	0.0964

Note: This table compares the evolution of value added tax between treated and control firms. The variable value added tax is constrcted from the ratio of reported value added tax to reported industrial sales.

Table 3. Determinants of Value Added Tax Reform Policy Treatment

Variables	Value Added Tax Reform (1 = Yes, 0 = No)					
	Outcome = DIF (2003, 2007)			Outcome = DIF (After 2004, Before 2004)		
	All	Domestic	Foreign	All	Domestic	Foreign
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign Share	-0.178	-3.453	-0.179	-0.159	-3.766	-0.179
	(0.30)***	(3.023)	(0.045)	(0.027)***	(2.884)	(0.045)
HKTM Share	-0.662	-0.862	-1.048	-0.671	-0.884	-1.048
	(0.044)***	(1.180)	(0.057)***	(0.040)***	(1.120)	(0.057)***
State Share	0.231	0.173	0.574	0.160	0.113	0.574
	(0.033)***	(0.035)***	(0.085)***	(0.026)***	(0.028)***	(0.085)***
Export Share	-0.027	-0.282	0.135	-0.048	-0.290	0.135
	(0.027)	(0.041)***	(0.036)***	(0.024)**	(0.0366)***	(0.036)***
log(Output)	-0.181	-0.180	-0.181	-0.149	-0.142	-0.181
	(0.011)***	(0.012)***	(0.018)***	(0.009)***	(0.010)***	(0.018)***
log(Fixedasset)	0.122	0.130	0.095	0.113	0.118	0.095
	(0.007)	(0.008)***	(0.012)***	(0.006)***	(0.007)***	(0.012)***
Age	-0.004	-0.003	-0.009	-0.004	-0.003	-0.009
	(0.001)***	(0.001)***	(0.002)***	(0.001)***	(0.001)***	(0.002)***
log(TFP)	0.198	0.189	0.254	0.161	0.143	0.254
	(0.032)***	(0.036)***	(0.054)***	(0.027)***	(0.031)***	(0.054)***
Obervations	97916	70851	33588	126580	92992	33588
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.0743	0.0671	0.1228	0.0719	0.0645	0.1228

Note: This table tests whether variables we used for matching are important determinants of policy treatment. Four different variable specifications were used: Specification 1 from column (1) to (3) defines outcome variables as the growth from 2003 to 2007, and control variables as the mean between 1998 and 2003; specification 2 in column (4) to (6) defines outcome variables as the difference between 2003 and 2007, and control variables as the average between 1998 and 2003. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 4. Balancing tests for propensity score matching

	Mean		% Bias	% Bias	t-test	
	Treated	Matched		Reduction	t-stat	p-value
Outcome = DIF(2003, 2007)						
All Sample						
Foreign Share	0.125	0.125	-0.300	97.6	-0.130	0.893
HKTM Share	0.035	0.033	0.700	97.9	0.460	0.643
State Share	0.114	0.112	0.700	96.4	0.280	0.780
Export Share	0.165	0.162	0.900	93.6	0.470	0.642
log(Output)	10.018	10.016	0.200	97.5	0.070	0.940
log(Fixedasset)	8.707	8.692	0.900	94.0	0.420	0.673
Age	15.199	15.251	-0.500	52.8	-0.210	0.835
log(TFP)	1.935	1.929	2.300	-374.9	1.080	0.278
Domestic						
Foreign Share	0.000	0.000	-0.100	98.0	-0.060	0.953
HKTM Share	0.000	0.000	-0.100	97.1	-0.040	0.966
State Share	0.130	0.133	-1.000	94.1	-0.370	0.710
Export Share	0.063	0.064	-0.600	97.8	-0.270	0.789
log(Output)	9.872	9.863	0.800	82.6	0.300	0.764
log(Fixedasset)	8.536	8.533	0.200	98.9	0.080	0.934
Age	16.228	16.331	-0.800	64.3	-0.320	0.751
log(TFP)	1.910	1.902	3.100	-213.2	1.260	0.209
Foreign						
Foreign Share	0.4745	0.4733	0.3000	99.1	0.08	0.939
HKTM Share	0.1275	0.1307	-1.0000	98.7	-0.31	0.755
State Share	0.0658	0.0723	-4.3000	82.6	-0.92	0.357
Export Share	0.4430	0.4273	3.7000	-15.7	0.90	0.370
log(Output)	10.3850	10.4120	-2.1000	81.0	-0.51	0.611
log(Fixedasset)	9.1595	9.1984	-2.3000	71.6	-0.55	0.582
Age	12.3980	12.4370	-0.6000	91.5	-0.14	0.886
log(TFP)	2.0042	2.0049	-0.3000	-43.7	-0.06	0.954
Outcome = DIF(Before 2004, After 2004)						
All Sample						
Foreign Share	0.113	0.115	-0.600	94.3	-0.310	0.755
HKTM Share	0.033	0.031	0.800	97.4	0.680	0.497
State Share	0.137	0.135	0.700	96.2	0.330	0.742
Export Share	0.151	0.149	0.700	96.0	0.380	0.707
log(Output)	9.922	9.930	-0.600	88.4	-0.320	0.749
log(Fixedasset)	8.638	8.624	0.800	94.8	0.450	0.654
Age	15.973	15.980	-0.100	97.7	-0.030	0.975
log(TFP)	1.914	1.911	1.100	-201.3	0.610	0.542
Domestic						
Foreign Share	0.000	0.000	-0.100	97.9	-0.080	0.933
HKTM Share	0.000	0.000	0.000	98.5	-0.030	0.980
State Share	0.158	0.163	-1.500	90.4	-0.650	0.514
Export Share	0.059	0.061	-0.800	96.8	-0.430	0.665
log(Output)	9.779	9.775	0.400	85.9	0.180	0.854
log(Fixedasset)	8.482	8.484	-0.100	99.4	-0.050	0.958
Age	17.075	17.165	-0.700	79.4	-0.300	0.761
log(TFP)	1.891	1.884	2.400	-450.2	1.080	0.280
Foreign						
Foreign Share	4.63E-01	4.63E-01	-0.2	99.4	-0.06	0.954
HKTM Share	0.13018	0.13165	-0.4	99.4	-0.15	0.878
State Share	0.07421	0.07814	-2.4	90.8	-0.57	0.566
Export Share	0.42773	0.41267	3.5	38.9	0.95	0.342
log(Output)	10.32	10.343	-1.7	81.2	-0.46	0.644
log(Fixedasset)	9.0977	9.1243	-1.5	85	-0.41	0.681
Age	12.692	12.682	0.1	96.7	0.04	0.97
log(TFP)	1.9937	1.9922	0.6	70.9	0.14	0.886

Note: This table tests whether there's significant difference between treated and matched groups on potential determinants of policy treatment. Four different variable specifications were used: Specification 1 defines outcome variables as the growth from 2003 to 2007, and control variables as the mean between 1998 and 2003; specification 2 defines outcome variables as the difference between means post and before treatment, and control variables as the average between 1998 and 2003.

Table 5.1. The Impact of Value-Added Tax Reform on Firm Behavior -- Outcome = DIF(2003, 2007)

				Common Support		Off Support	
	Matching Estimate	Std. Err.	T-stat	Untreated	Treated	Untreated	Treated
All Sample							
VAT/Industrial sales	-0.008	(0.002)***	-3.31	93525	4304	0	87
log(Labor)	-0.077	(0.011)***	-7.30	93536	4304	0	87
log(Fixed assets for production)	-0.047	(0.019)**	-2.43	88045	3944	0	80
log(Investment)	0.014	(0.069)	0.2	31876	1200	0	24
Profit/Industrial sales	0.021	(0.012)*	1.81	93525	4304	0	87
log(TFP)	0.010	(0.006)	1.6	88045	3944	0	80
Export Intensity	-0.021	(0.003)***	-6.25	93525	4304	0	87
All Domestic							
VAT/Industrial sales	-0.013	(0.003)***	-4.39	67642	3145	0	64
log(Labor)	-0.0763	(0.012)***	-6.18	67649	3145	0	64
log(Fixed assets for production)	-0.0229	(0.023)	-0.98	63776	2884	0	58
log(Investment)	-0.0440	(0.084)	-0.52	21772	860	0	17
Profit/Industrial sales	0.0376	(0.016)**	2.37	67642	3145	0	64
log(TFP)	0.0055	(0.007)	0.74	63776	2884	0	58
Export Intensity	-0.0075	(0.003)***	-2.57	67642	3145	0	64
Domestic Non-SOE							
VAT/Industrial sales	-0.007	(0.003)***	-2.91	63327	2867	0	58
log(Labor)	-0.078	(0.013)***	-6.09	63327	2867	0	58
log(Fixed assets for production)	-0.032	(0.025)	-1.32	59825	2622	0	53
log(Investment)	-0.031	(0.089)	-0.34	20465	790	0	16
Profit/Industrial sales	-0.004	(0.010)	-0.38	63327	2867	0	58
log(TFP)	0.005	(0.008)	0.65	59825	2622	0	53
Export Intensity	-0.008	(0.003)**	-2.39	63327	2867	0	58
Domestic SOE							
VAT/Industrial sales	-0.076	(0.030)**	-2.53	3975	279	0	5
log(Labor)	-0.0597	(0.045)	-1.33	3975	279	0	5
log(Fixed assets for production)	0.1226	(0.073)*	1.66	3644	262	0	5
log(Investment)	0.1680	(0.264)	0.64	1165	70	0	1
Profit/Industrial sales	0.4754	(0.234)**	2.03	3975	279	0	5
log(TFP)	0.0026	(0.031)	0.08	3644	262	0	5
Export Intensity	-0.0034	(0.006)	-0.59	3975	279	0	5
All Foreign							
VAT/Industrial sales	0.005	(0.004)	1.12	25883	1159	0	23
log(Labor)	-0.0616	(0.030)***	-3.03	25887	1159	0	23
log(Fixed assets for production)	-0.0801	(0.032)**	-2.50	24269	1061	0	21
log(Investment)	0.1849	(0.121)	1.53	9171	341	0	6
Profit/Industrial sales	-0.0163	(0.005)***	-3.02	25883	1159	0	23
log(TFP)	0.0172	(0.012)	1.39	24269	1061	0	21
Export Intensity	-0.0601	(0.010)***	-5.98	25883	1159	0	23

Note: This table presents matching estimation results. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 5.2. The Impact of Value-Added Tax Reform on Firm Behavior -- Outcome = DIF(Before 2004, After 2004)

				Common Support		Off Support	
	Matching Estimate	Std. Err.	T-stat	Untreated	Treated	Untreated	Treated
All Sample							
VAT/Industrial sales	-0.003	(0.009)	-0.35	120787	5678	0	115
log(Labor)	-0.118	(0.009)***	-13.22	120793	5678	0	115
log(Fixed assets for production)	-0.023	(0.014)	-1.61	118833	5598	0	114
log(Investment)	-0.029	(0.038)	-0.77	72096	2940	0	59
Profit/Industrial sales	0.139	(0.081)*	1.72	120787	5678	0	115
log(TFP)	-0.009	(0.005)*	-1.93	118833	5598	0	114
Export Intensity	-0.019	(0.002)***	-7.67	120787	5678	0	115
All Domestic							
VAT/Industrial sales	-0.020	(0.06)***	-3.39	88651	4255	0	86
log(Labor)	-0.116	(0.010)***	-11.47	88657	4255	0	86
log(Fixed assets for production)	0.008	(0.017)	0.46	87098	4192	0	85
log(Investment)	-0.049	(0.046)	-1.08	50625	2121	0	43
Profit/Industrial sales	0.196	(0.107)*	1.82	88651	4255	0	86
log(TFP)	-0.012	(0.005)**	-2.21	87098	4192	0	85
Export Intensity	-0.011	(0.002)***	-5.06	88651	4255	0	86
Domestic Non-SOE							
VAT/Industrial sales	-0.021	(0.007)***	-3.27	80526	3744	0	76
log(Labor)	-0.124	(0.010)***	-12	80529	3744	0	76
log(Fixed assets for production)	0.002	(0.018)	0.12	79273	3689	0	75
log(Investment)	-0.026	(0.049)	-0.53	45953	1863	0	38
Profit/Industrial sales	-0.017	(0.005)***	-3.11	80526	3744	0	76
log(TFP)	-0.019	(0.005)***	-3.51	79273	3689	0	75
Export Intensity	-0.012	(0.002)***	-5.07	80526	3744	0	76
Domestic SOE							
VAT/Industrial sales	-0.0229	(0.011)**	-2.02	7342	511	0	10
log(Labor)	-0.0793	(0.032)**	-2.41	7342	511	0	10
log(Fixed assets for production)	0.0474	(0.043)	1.09	7072	503	0	10
log(Investment)	-0.1833	(0.128)	-1.43	4159	258	0	5
Profit/Industrial sales	1.7379	(1.221)	1.42	7342	511	0	10
log(TFP)	0.0284	(0.020)	1.42	7072	503	0	10
Export Intensity	0.0005	(0.004)	0.11	7341	511	0	10
All Foreign							
VAT/Industrial sales	0.054	(0.034)	1.58	32136	1423	0	29
log(Labor)	-0.092	(0.019)***	-4.96	32136	1423	0	29
log(Fixed assets for production)	-0.081	(0.026)***	-3.13	31735	1407	0	28
log(Investment)	0.055	(0.067)	0.82	20369	819	0	16
Profit/Industrial sales	0.023	(0.030)	0.76	32136	1423	0	29
log(TFP)	0.003	(0.009)	0.28	31735	1407	0	28
Export Intensity	-0.043	(0.007)***	-5.72	32136	1423	0	29

Note: This table presents matching estimation results. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 6.1. OLS Estimation: The Impact of Value-Added Tax Reform on Firm Behavior -- VAT/Sales Change Dummy, Outcome = DIF(2003, 2007)

VARIABLES	log(Labor)	log(K for production)	log(Investment)	Profit/Sales	log(TFP)	Export Intensity
	(1)	(2)	(3)	(4)	(5)	(6)
All Sample						
VAT/Sales Reduction	-0.0303***	-0.0195***	-0.0317	-0.0283	0.0363***	0.00443***
(1 = Yes, 0 = No)	(0.00368)	(0.00637)	(0.0229)	(0.0259)	(0.00213)	(0.00156)
Observations	97,916	92,063	33,094	97,916	92,063	97,916
R-squared	0.218	0.183	0.052	0.006	0.201	0.006
All Domestic						
VAT/Sales Reduction	-0.0289***	-0.0226***	-0.0190	-0.0425	0.0377***	-0.00399**
(1 = Yes, 0 = No)	(0.00427)	(0.00758)	(0.0272)	(0.0352)	(0.00248)	(0.00158)
Observations	70,851	66,713	23,076	70,851	66,713	70,851
R-squared	0.205	0.189	0.059	0.007	0.213	0.006
Domestic Non-SOE						
VAT/Sales Reduction	-0.0273***	-0.0218***	-0.0181	-0.0196	0.0359***	-0.00391**
(1 = Yes, 0 = No)	(0.00439)	(0.00781)	(0.0281)	(0.0250)	(0.00250)	(0.00168)
Observations	66,252	62,496	21,696	66,252	62,496	66,252
R-squared	0.201	0.191	0.063	0.004	0.222	0.006
Domestic SOE						
VAT/Sales Reduction	-0.0540***	-0.0420	-0.0715	-0.381	0.0635***	-0.00593*
(1 = Yes, 0 = No)	(0.0176)	(0.0311)	(0.110)	(0.398)	(0.0128)	(0.00343)
Observations	4,599	4,217	1,380	4,599	4,217	4,599
R-squared	0.154	0.089	0.036	0.058	0.128	0.020
All Foreign						
VAT/Sales Reduction	-0.0350***	-0.00988	-0.0401	0.0129***	0.0337***	0.0273***
(1 = Yes, 0 = No)	(0.00719)	(0.0117)	(0.0424)	(0.00243)	(0.00413)	(0.00386)
Observations	27,065	25,350	10,018	27,065	25,350	27,065
R-squared	0.258	0.154	0.036	0.041	0.174	0.011

Notes: This table presents OLS estimation results. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 6.2. OLS Estimation: The Impact of Value-Added Tax Reform on Firm Behavior -- VAT/Sales Change Dummy, DIF(Before 2004, After 2004)

VARIABLES	log(Labor)	log(K for production)	log(Investment)	Profit/Sales	log(TFP)	Export Intensity
	(1)	(2)	(3)	(4)	(5)	(6)
			All Sample			
VAT/Sales Reduction	-0.0236***	-0.00134	0.00210	-0.256	0.0316***	0.00650***
(1 = Yes, 0 = No)	(0.00305)	(0.00475)	(0.0133)	(0.222)	(0.00154)	(0.00115)
Observations	126,580	124,540	75,093	126,580	124,540	126,580
R-squared	0.295	0.222	0.059	0.002	0.255	0.007
			All Domestic			
VAT/Sales Reduction	-0.0215***	-0.00372	0.0183	-0.324	0.0341***	-0.00143
(1 = Yes, 0 = No)	(0.00354)	(0.00563)	(0.0159)	(0.287)	(0.00182)	(0.00117)
Observations	92,992	91,370	52,787	92,992	91,370	92,992
R-squared	0.275	0.225	0.066	0.002	0.261	0.006
			Domestic Non-SOE			
VAT/Sales Reduction	-0.0187***	-0.00635	0.0237	-0.00522	0.0324***	-0.00188
(1 = Yes, 0 = No)	(0.00368)	(0.00586)	(0.0166)	(0.00668)	(0.00178)	(0.00127)
Observations	84,346	83,034	47,853	84,346	83,034	84,346
R-squared	0.254	0.228	0.072	0.001	0.280	0.006
			Domestic SOE			
VAT/Sales Reduction	-0.0560***	-0.0186	-0.0553	-2.555	0.0488***	0.00260
(1 = Yes, 0 = No)	(0.0125)	(0.0194)	(0.0546)	(2.292)	(0.00925)	(0.00213)
Observations	8,646	8,336	4,934	8,646	8,336	8,646
R-squared	0.244	0.115	0.036	0.013	0.183	0.017
			All Foreign			
VAT/Sales Reduction	-0.0323***	-0.000620	-0.0210	-0.0284	0.0274***	0.0280***
(1 = Yes, 0 = No)	(0.00596)	(0.00876)	(0.0240)	(0.0425)	(0.00292)	(0.00293)
Observations	33,588	33,170	22,306	33,588	33,170	33,588
R-squared	0.346	0.215	0.043	0.001	0.245	0.014

Notes: This table presents OLS estimation results. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 7.1. IV Estimation: The Impact of Value-Added Tax Reform on Firm Behavior -- VAT/Sales Change Dummy, Outcome = DIF(2003, 2007)

	First stage	Second stage					
VARIABLES		log(Labor)	log(K for production)	log(Investment)	Profit/Sales	log(TFP)	Export Intensity
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All Sample							
VAT/Sales Reduction	0.0162**	-4.766**	-2.669	1.559	0.455	1.195	-1.400**
(1 = Yes, 0 = No)	(0.00772)	(2.300)	(2.161)	(2.551)	(1.390)	(0.971)	(0.707)
Observations	97,916	97,916	92,063	33,094	97,916	92,063	97,916
All Domestic							
VAT/Sales Reduction	0.0275***	-3.004***	-0.647	-0.331	0.472	0.451	-0.306**
(1 = Yes, 0 = No)	(0.00905)	(1.028)	(0.891)	(1.909)	(1.084)	(0.336)	(0.149)
Observations	70,851	70,851	66,713	23,076	70,851	66,713	70,851
Domestic Non-SOE							
VAT/Sales Reduction	0.0287***	-2.822***	-0.896	-0.527	-0.971	0.535	-0.296**
(1 = Yes, 0 = No)	(0.00948)	(0.975)	(0.918)	(1.798)	(0.981)	(0.352)	(0.150)
Observations	66,252	66,252	62,496	21,696	66,252	62,496	66,252
Domestic SOE							
VAT/Sales Reduction	0.0146	-6.094	8.145	-35.58	9.220	-1.037	-0.283
(1 = Yes, 0 = No)	(0.0309)	(13.04)	(26.47)	(470.9)	(22.61)	(4.585)	(0.716)
Observations	4,599	4,599	4,217	1,380	4,599	4,217	4,599
All Foreign							
VAT/Sales Reduction	-0.0129	4.229	3.986	-47.03	0.525	-1.171	3.226
(1 = Yes, 0 = No)	(0.0148)	(5.077)	(4.003)	(297.6)	(0.856)	(1.214)	(2.577)
Observations	27,065	27,065	25,350	10,018	27,065	25,350	27,065

Notes: This table presents IV estimation results. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 7.2. IV Estimation: The Impact of Value-Added Tax Reform on Firm Behavior -- VAT/Sales Change Dummy, DIF(Before 2004, After 2004)

	First stage	Second stage					
VARIABLES		log(Labor)	log(K for production)	log(Investment)	Profit/Sales	log(TFP)	Export Intensity
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All Sample							
VAT/Sales Reduction	0.0219***	-4.883***	-0.0979	0.173	7.325	0.0220	-0.834***
(1 = Yes, 0 = No)	(0.00675)	(1.517)	(0.593)	(1.127)	(7.308)	(0.200)	(0.278)
Observations	126,580	126,580	124,540	75,093	126,580	124,540	126,580
All Domestic							
VAT/Sales Reduction	0.0343***	-3.446***	0.461	-0.449	5.657	-0.137	-0.339***
(1 = Yes, 0 = No)	(0.00781)	(0.809)	(0.452)	(0.794)	(5.709)	(0.144)	(0.101)
Observations	92,992	92,992	91,370	52,787	92,992	91,370	92,992
Domestic Non-SOE							
VAT/Sales Reduction	0.0368***	-3.025***	0.832*	0.171	-0.505	-0.165	-0.335***
(1 = Yes, 0 = No)	(0.00833)	(0.712)	(0.489)	(0.848)	(0.313)	(0.142)	(0.101)
Observations	84,346	84,346	83,034	47,853	84,346	83,034	84,346
Domestic SOE							
VAT/Sales Reduction	0.0306	-4.380	-0.210	-2.711	-2.553	-0.0229	-0.0838
(1 = Yes, 0 = No)	(0.0226)	(3.314)	(1.131)	(2.132)	(14.74)	(0.496)	(0.161)
Observations	8,646	8,646	8,336	4,934	8,646	8,336	8,646
All Foreign							
VAT/Sales Reduction	-0.00880	6.527	3.798	-4.382	-3.092	-1.288	2.740
(1 = Yes, 0 = No)	(0.0133)	(10.21)	(5.497)	(5.402)	(6.355)	(1.585)	(2.613)
Observations	33,588	33,588	33,170	22,306	33,588	33,170	33,588

Notes: This table presents IV estimation results. * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Appendix Tables

Table A1. Replicate Nie et al (2010) results: All Sample

	1999-2003 and 2005			1998-2007		
VARIABLES	Fixed assets growth (nominal)	Fixed assets growth (reall)	LogL	Fixed assets growth (nominal)	Fixed assets growth (reall)	LogL
	(1)	(2)	(3)	(4)	(5)	(6)
VAT policy	8,738*	8,857*	-0.0925***	2,331	2,935	-0.111***
	(4,863)	(4,780)	(0.00843)	(2,471)	(2,782)	(0.00855)
Firm size (logSales)	397.9	490.6	0.00892***	3,843***	2,934**	0.00745***
	(3,561)	(3,187)	(0.00153)	(1,480)	(1,447)	(0.00162)
Profit	0.870*	0.692		0.284	0.115	
	(0.509)	(0.451)		(0.174)	(0.167)	
Foreign Share	-8,722***	-7,914***	0.146***	-6,455***	-5,241***	0.182***
	(2,423)	(2,280)	(0.00751)	(1,622)	(1,545)	(0.00794)
HKTM Share	-1,778*	-1,599*	0.0672***	-2,438***	-1,987**	0.0956***
	(976.4)	(934.4)	(0.00701)	(905.2)	(849.4)	(0.00732)
State Share	10,257***	9,330***	-0.352***	9,385***	7,307***	-0.428***
	(3,173)	(3,005)	(0.00698)	(2,422)	(2,198)	(0.00717)
Export Share	2,051	1,702	0.0209***	-324.2	-431.9	0.00127
	(1,670)	(1,472)	(0.00587)	(644.7)	(607.1)	(0.00607)
Profit-sales ratio			0.000218			-0.00102
			(0.00125)			(0.00161)
Observations	91,578	90,975	121,597	96,222	95,459	128,777
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.087	0.062	0.036	0.018	0.007	0.047

Table A2. Replicate Nie et al (2010) results: Stateowned Firms

	1999-2003 and 2005			1998-2007		
VARIABLES	Fixed assets growth (nominal)	Fixed assets growth (reall)	LogL	Fixed assets growth (nominal)	Fixed assets growth (reall)	LogL
	(1)	(2)	(3)	(4)	(5)	(6)
VAT policy	91,828**	94,221**	-0.0785**	28,810	37,324	-0.0767**
	(40,327)	(39,737)	(0.0313)	(20,795)	(24,395)	(0.0315)
Firm size (logSales)	14,816***	14,032***	0.0140***	10,016**	8,651**	0.00940**
	(4,148)	(3,977)	(0.00385)	(3,982)	(3,793)	(0.00406)
Profit	0.765	0.692		1.559***	1.291***	
	(0.691)	(0.637)		(0.590)	(0.500)	
Foreign Share	-153,072	-141,586	-0.622	-289,068**	-273,298**	-0.321
	(133,346)	(129,895)	(0.465)	(129,113)	(132,694)	(0.376)
HKTM Share	-78,407	-112,568	-0.119	-319,417*	-312,192*	-0.0675
	(128,457)	(124,240)	(0.302)	(188,349)	(172,661)	(0.332)
State Share	8,366	237.5	-0.0364	-5,317	-11,736	-0.0458*
	(12,497)	(16,769)	(0.0222)	(10,809)	(15,119)	(0.0244)
Export Share	-36,952**	-39,383***	-0.0673	-26,949**	-31,486**	-0.117**
	(14,490)	(13,981)	(0.0532)	(13,437)	(13,086)	(0.0563)
Profit-sales ratio			0.0112*			0.0142
			(0.00639)			(0.00899)
Observations	7,423	7,344	8,217	7,996	7,882	8,995
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.055	0.054	0.008	0.151	0.119	0.010

Table A3. Replicate Nie et al (2010) results: Non-stateowned Firms

	1999-2003 and 2005			1998-2007		
VARIABLES	Fixed assets growth (nominal)	Fixed assets growth (reall)	LogL	Fixed assets growth (nominal)	Fixed assets growth (reall)	LogL
	(1)	(2)	(3)	(4)	(5)	(6)
VAT policy	-2,174	-2,214	-0.0920***	-993.1	-1,262	-0.112***
	(1,941)	(1,741)	(0.00871)	(1,087)	(977.6)	(0.00885)
Firm size (logSales)	-3,995	-3,843	0.0101***	1,938	1,011	0.00926***
	(4,482)	(4,005)	(0.00170)	(1,267)	(1,139)	(0.00180)
Profit	0.898	0.694		-0.0306	-0.173**	
	(0.610)	(0.543)		(0.0746)	(0.0753)	
Foreign Share	-5,085**	-4,027**	0.141***	-2,078*	-997.5	0.174***
	(2,154)	(1,979)	(0.00754)	(1,253)	(1,137)	(0.00796)
HKTM Share	-335.2	-128.0	0.0626***	-1,181	-800.8	0.0895***
	(1,142)	(1,043)	(0.00703)	(881.8)	(793.3)	(0.00734)
State Share	12,089**	9,538**	-0.348***	1,954	-156.0	-0.410***
	(5,287)	(4,777)	(0.0123)	(2,680)	(2,276)	(0.0124)
Export Share	2,350	1,919	0.0202***	-787.5	-834.3*	0.000763
	(1,831)	(1,628)	(0.00591)	(478.9)	(438.1)	(0.00611)
Profit-sales ratio			-0.000215			-0.00151
			(0.000849)			(0.00117)
Observations	84,155	83,631	113,380	88,226	87,577	119,782
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.136	0.102	0.019	0.002	0.011	0.024